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ABSTRACT

This unit of instruction was designed as an intensive in-depth study of the nervous impulse, neurons, brain, spinal cord, and sensory organs. Also included is a study of the endocrine system in its role of maintaining homeostasis. The booklet lists the relevant state-adopted texts and states the performance objectives for the unit. It provides an outline of the course content and suggests experiments, demonstrations, speakers, and topics for student projects and reports. Also listed are relevant films, film loops, slides, film strips, and transparencies available from the Dade County Audiovisual Center. Reference books are recommended, and a master sheet is provided relating each suggested activity to the specific performance objectives. (JR)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

THE NERVOUS SYSTEM

5363.02
5346.02

SCIENCE
(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

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SCIENCE
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Written by Alan Weiss,
Richard Petty,
and Peter Saponaro
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Fla.
1971

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THE NERVOUS SYSTEM

COURSE DESCRIPTION:

This course will include an intensive in-depth study of the nerve impulse, naurons, brain, spinal cord, and sensory organs. The endocrine system will also be treated due to its dual role in maintaining homeostasis.

ENROLLMENT GUIDELINES:

"The Nervous System" is a course for the interested student and should follow credit or background in previous biology programs. It is, in part a second course in biology, but it is well within the range of the average student.

STATE ADOPTED TEXTS:

1. Kimber, Diana et al. Anatomy and Physiology 15th ed. New York: The Macmillan Co., 1966.

2. Morrison, Thomas F.; Cornett, Frederick D.; Tether, J. Edward; and Gratz, Pauline. Human Physiology. New York: Holt, Rinehart and Winston Inc., 1967.

3. Morrison, Thomas F.; Cornett, Frederick D.; Tether, J. Edward; and Gratz, Pauline. Experiments in Physiology. New York: Holt, Rinehart and Winston Inc., 1967.

PERFORMANCE OBJECTIVES

1. Given a drawing of a "typical" neuron, identify the following: axon, cell body, dendrite, nissl bodies, node of Ranvier, neurilemma, and the myelin sheath.

2. Distinguish among the different types of neurons: pyramidal, purkinje, motor (efferent), sensory (afferent), and associative (connecting).

3. Integrate the following with regard to the nerve impulse: sodium ions, potassium ions, refractory periods, action potential, myelin sheath, neurilemma, node of Ranvier, threshold, summation, and the "all or none" law.

4. Given a diagram of a simple reflex arc explain the roles of the receptor, neurons, and effectors involved.

5. Integrate and plate potential, acetylcholine, and cholinesterase as they apply to a nerve impulse crossing a synapse.

6. Differentiate between the two major divisions of the autonomic nervous system, in terms of anatomy and their actions within the body.

7. Relate the anatomical differences between gray and white matter in the spinal cord and brain to the functions they perform in nervous control.

8. Relate the functions of the parts of the brain as they contribute to the total function of the brain. Include the following: medulla, pons, mid brain, cerebellum, the interbrain (thalmus, nypothalmus), the cerebrum, and the cranial nerves.

9. Discuss critically the relationship between normal nervous activity and that of various nervous disorders. Include meningitis, polio-myelitis, cerebral palsy, hydroencephalitis, multiple sclerosis, Parkinson's disease, Huntington's chorea, epilepsy.

10. On a practical examination of the cat identify the major regions of the brain, cranial nerves and selected major peripheral nerves.

11. List the functions of the following parts of the eye: cornea, sclera, choroid, iris, pupil, retina, fovea centralis, aqueous humor, vitreous humor, lens, conjunctiva, cilliary muscle, optic nerve, suspensory ligaments.

12. Describe the chemical changes within both rods and cones when stimulated by light.

13. Analyze the effect of the distribution and concentration of rods and cones upon the retina in terms of visual acuity and night vision.

14. Investigate the following disorders of the eye: glaucoma, tracoma, cataract, conjunctivitis, myopia, hyperopia, strabismus, astigmatism, presbyopia.

15. List the functions of the following parts of the ear: pinna, external acoustic meatus, tympanic membrane, middle ear structures, cochlea, semicircular canals, and eustachian tubes.

16. Describe the transmission of a sound impulse from its source, through the ear, to an impulse, to an auditory nerve.

17. Distinguish between the sensations of taste and smell.

18. Discuss critically the "feedback mechanisms" for regulating hormone levels within the body.

19. Discriminate between the following endocrine glands as to hormone secreted and its action within the body: pituitary (anterior and posterior lobes). pineal gland, parathyroid gland, thyroid gland, adrenal gland, pancreas, testes, ovaries, gastric mucosa.

COURSE OUTLINE

I. Nervous Coordination

   A. Central and peripheral systems

   B. Receptors and effectors

   C. Neuron structure

   D. Nerve impulse and synapses

II. Central Nervous System

   A. Spinal cord and nerves

   B. Reflex action and reciprocal innervation

   C. Brain structure and function

   D. Conditioned reflexes

   E. Structure and function of the autonomic nervous system

   F. Disorders of the nervous system

III. The Eye

   A. Anatomy of the orbital cavity and eye muscles

   B. Binocular and sterioscopic vision

C. Spatial relationships

D. Night vision

E. Color vision and color blindness

F. Visual acuity

G. Visual defects and their correction

H. Diseases of the eye

IV. The Ear

A. Anatomy of the ear

B. Physics of sound

C. Physiology of hearing

D. Auditory defects

E. Balance

V. Taste and Smell

A. Taste buds

1. Salt, sweet, sour, and bitter tastes
2. Innervation

B. Smell

1. Olfactory epithelium
2. Innervation and the olfactory bulb

VI. Endocrine Glands

A. Production of hormones

B. Effects of hormones

EXPERIMENTS AND/OR DEMONSTRATIONS

Chaffee, Ellen. Laboratory Manual in Physiology and Anatomy. Philadelphia: Lippincott, 1969.

1. Introduction to the Nervous System (Ex. 9, p. 79)
2. The Brain and Cranial Nerves (Ex. 10, p. 91)
3. The Autonomic System (Ex. 11, p. 101)
4. The Eye (Ex. 12A, p. 107)
5. Taste Sensations (Ex. 12B, p. 115)
6. Cutaneous Sensations (Ex. 12C, p.116)
7. Hearing and Equilibrium (Ex. 13, p. 117)
8. The Endocrine Glands (Ex. 23, p. 227)

Anthony, Catherine Parker. Anatomy and Physiology Laboratory Manual. St. Louis: C. V. Mosby Company, 1967.

9. Anatomy of the Brain (Ex. A, B, C, p. 103)
10. Anatomy of the Spinal Cord (Ex. D, E, p. 113)
11. Physiology of the Nervous System (Ex. A - H, p. 119)
12. The Eye (Ex. A, B, p. 137)
13. The Ear (Ex. C, p. 143)
14. Taste (Ex. D, p. 147)
15. Kinesthesia (Ex. E, p. 149)
16. The Endocrine System (Ex. A, B, C, p. 229)

Leavell, Lutie; Chapin, Florence; and Miller, Marjorie. Workbook and Laboratory Manual in Anatomy and Physiology. New York: Macmillan Company, 1964.

17. General Considerations of the Nervous System (Ex. A, p. 83)
18. The Neuron and Its Relation to Spinal Reflex (Ex. B, C. p. 84)
19. Physiology of Reflexes (Ex. D, p. 86)
20. The Spinal Cord (Ex. E, p. 88)
21. The Autonomic Nervous System (Ex. F, p. 93)
22. The Brain and Human Brain (Ex. G,H, p. 98)
23. The Cranial Nerves (Ex. I, p. 107)
24. Types of Endocrine Glands and Their Functions (Ex. A, B, p. 145)
25. The Sensory Units and Sensations (Ex. A, B, C, p. 191)
26. Correlation Between Taste and Smell (Ex. A, p. 195)
27. Nerve Supply and Fatigue (Ex. B, C, p. 196)
28. Pain (Ex. A, p. 193)
29. Structure and Function of the Internal Ear (Ex. A, p. 197)
30. The Internal Ear and Equilibrium (Ex. A, B, p. 201)
31. Structure and Function of the Eye (Ex. A, p. 203)
32. The Optic Nerve (Ex. B, p. 208)

Tuttle, W. W. and Schottelius, Byron. Physiology Laboratory Manual. St. Louis: C. V. Mosby Company, 1963.

33. Bioelectricity — Nerve (Ex. 40, p. 123)
34. Propagation of the Nerve Impulse through the Reflex Arc (Ex. 41, p.127)

35. Reflexes in Man and Inhibition (Ex. 42, 43, p. 130)
36. Functions of the Cerebrum (Ex. 44, p. 134)
37. Cutaneous Sensations (Ex. 45, p. 137)
38. Vision (Ex. 46, p. 141)
39. Hearing (Ex. 47, p. 148)
40. Sensation of Taste (Ex. 48, p. 150)

Jones, Claiborne and Lehman, Lillian. Laboratory Guide in Introductory Vertebrate Zoology. Chapel Hill: Department of Zoology, University of North Carolina, 1969.

41. Nervous System of the Frog (Ex. IV, p. 61)
42. Brain and Cranial Nerves of the Dogfish Shark (Ex. IV, p. 64)
43. Sense Organs of Dogfish Shark (Ex. IV, p. 69)
44. Physiology of the Nervous System (Ex. IV, p. 71)

Elliott, A. M. Laboratory Guide for Zoology. Minneapolis: Burgess Publishing Co., 1957.

45. Nervous System of the Frog (Ex. IV, p. 164)
46. Nervous System of the Fetal Pig (Ex. V, p. 205)
47. Sense Organs of the Fetal Pig (Ex. V, p. 209)

Biological Sciences Curriculum Study. Biological Sciences: Molecules to Man. Boston: Houghton Mifflin Company, 1963.

48. The Eye (Ex. 53, p. 109)
49. Chemical Receptors (Ex. 54, p. 112)

Booth, Ernest S., and Chiasson, Robert B. Laboratory Anatomy of the Cat. Dubuque: Wm. C. Brown Company, 1970.

50. The Nervous System of the Cat (Chapter 8, p. 51)

Morrison, Thomas F.; Cornett, Frederick D.; Tether, J. Edward; Gratz, Pauline. Experiments in Physiology. New York: Holt, Rinehart and Winston Inc., 1967.

51. Human Reflexes (Ex. 22, p. 23)
52. Reaction Time and Discrimination (Ex. 23, p. 24)
53. The Ability to Solve a Problem (Ex. 24, p. 25)
54. A Conditioned Reflex (Ex. 25, p. 25)
55. The Acuity of Vision (Ex. 26, p. 26)
56. Color Blindness (Ex. 27, p. 27)
57. The Area of Color Sensitivity on the Retina (Ex. 28, p. 27)
58. After-Images (Ex. 29, p. 28)
59. Stereoscopic Vision (Ex. 30, p. 29)
60. Accommodation of the Eye (Ex. 31, p. 29)
61. Movement of the Eyes When Reading (Ex. 32, p. 29)
62. The Blind Spot (Ex. 33, p. 30)
63. Auditory Acuity (Ex. 34, p. 30)
64. The Transmission of Sound (Ex. 36, p. 31)

65. The Characteristics of Sound (Ex. 36, p. 31)
66. Bone Transmission of Sound (Ex. 37, p. 32)
67. Equilibrium (Ex. 38, p. 32)
68. The Effect of Thyroxin on the Metamorphosis of Tadpoles (Ex. 81, p.66)
69. The Effect of Iodine on the Metamorphosis of Tadpoles (Ex. 82, p. 67)
70. Radioactive Iodine as a "Tracer Element" (Ex. 83, p. 67)
71. The Action of Insulin on the Rat (Ex. 85, p. 68)

PROJECTS

1. Construct an electrical audiometer.
2. Construct a color blindness test series of slides.
3. Construct a single point perspective room.
4. Construct a window trapezoid which revolves.
5. Train experimental animal to respond to specific stimuli.

REPORTS

1. Selective reports on diseases and/or disorders of the nervous system including the senses.
2. Sleep and Dreaming.
3. RNA and Memory.
4. Coordination.

SPEAKERS

1. Neurologist or Neuro-surgeon.
2. Otolaryngologist.
3. Optometrist or Opthalmologist.

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Fundamentals of the Nervous System
   AV#1-11276, 16 minutes, C
2. Exploring the Human Nervous System
   AV#1-30720, 23 minutes, C
3. The Human Brain
   AV#1-03060, 11 minutes, BW
4. Gateways to the Mind, Part 1
   AV#1-30718, 30 minutes, C
5. Gateways to the Mind, Part 2
   AV#1-30719, 30 minutes, C
6. Sense Perception, Part 1
   AV#1-30024, 27 minutes, C
7. Sense Perception, Part 2
   AV#1-30025, 28 minutes, C
8. Visual Perception
   AV#1-10667, 19 minutes, C
9. Ears: The Structure and Care
   AV#1-03067, 11 minutes, BW
10. Eyes and Their Care
    AV#1-03141, 11 minutes, BW
11. Ears and Hearing
    AV#1-03067, 10 minutes, BW
12. How the Ear Functions
    AV#1-03076, 11 minutes, BW
13. How the Eye Functions
    AV#1-03148, 11 minutes, BW
14. Human Body: The Nervous System
    AV#1-11277, 14 minutes, C
15. Human Body: The Respiratory System
    AV#1-11211, 13½ minutes, C
16. Nervous System
    AV#1-03152, 11 minutes, BW
17. The Nervous System (A.I.B.S.) Pt. 4, No. 9
    AV#1-30681, 28 minutes, C
18. Senses: (A.I.B.S.) Pt. 4, No. 10
    AV#1-30413, 28 minutes, C
19. The Spinal Column
    AV#1-03059, 11 minutes, BW
20. Endocrine Glands
    AV#1-03441, 11 minutes, BW
21. Endocrine Glands: How They Affect You
    AV#1-11367, 15 minutes, BW
22. Principles of Endocrine Activity
    AV#1-11213, 16 minutes, C

FILM LOOPS

Norris Physiology Series, Ward's Catalog

1. Turtle Heart Neural Control I, 73W1725.
2. Turtle Heart Neural Control II, 73W1726.
3. Removing Frog Pituitary, 73W1804.

EMEC Catalog

4. Nerve Action-Reflex Arc, 80101.
5. The Eye-Visual Accommodation, 80096.
6. The Eye-Nearsightedness, 80097.
7. The Eye-Farsightedness. 80098.
8. The Ear-Its Structure and Function, 80099.
9. The Ear-Perception of Sound, 80100.

Ealing Catalog

10. Nerve Impulse, Pt. 1, Making the Preparation, 81-5605/1.
11. Nerve Impulse, Pt. 2, Performing the Demonstration, 81-5647/1.

CCM Films Catalog

12. Part 1, Dissection of the Bull's Eye, BZ-398-1 48713.
13. Part 2, Diagram of the Eye, BZ-398-2, 48714.

SLIDES 2" x 2"

Ward's Catalog

1. The Endocrine System, 170W 8250, 13 slides.
2. Nervous System, 170W 8400, 24 slides.

FILM STRIPS

Eye Gate House, Inc.

1. Nervous Systems, 2-1-G.
2. Endocrine Systems, 2-1-H.

Film of the Month

3. Homeostatic Regulation, 1535.
4. Hormones, 1551.

TRANSPARENCIES AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. The Endocrine Glands, AV#2-00045
2. Endocrine Glands-Man, AV#2-00063
3. Eye, AV#2-00089
4. Nervous System-Man, AV#2-00065
5. Structure of an Eye, No. 1, AV#2-00123
6. Structure of an Eye, No. 2, AV"2-00123
7. Structure of the Human Ear, AV#2-00169
8. Structure of the Human Ear, AV#2-00052
9. Structure of the Human Eye, AV#2-00049

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3. Chaffee, Ellen, and Greisheimer, Esther. Basic Physiology and Anatomy. Philadelphia: J. B. Lippincott Co., 1969.

4. Crouch, James. Functional Human Anatomy. Philadelphia: Lea and Febiger, 1970.

5. DeRobertis, E. D. P.; Nowinski, Wiktor W.; and Saez, Bancino A. Cell Biology. Philadelphia: W. B. Saunders, 1968.

6. Frohse, Franz; Brodel, Max; and Schlossberg, Leon. Atlas of Human Anatomy. New York: Barnes and Noble, 1961.

7. Ganong, William F. Review of Medical Physiology. Los Altos, California: Lange Medical Publications, 1965.

8. Guyton, Arthur. Function of the Human Body. Philadelphia: W. B. Saunders Co., 1969.

9. Jacob, Stanley and Francone, Clarice. Structure and Function in Man. Philadelphia: W. B. Saunders Co., 1965.

10. Torrey, Theodore W., Morphogenesis of the Vertebrates. New York: John Wiley and Sons Co., 1967.

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